Analysis of Reflectance Spectra for the Icy Galilean Satellites from the Galileo Mission Near Infrared Mapping Spectrometer (NIMS) Investigation

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We present preliminary analysis of NIMS reflectance spectra for regions on the icy Galilean Satellites and specifically the interpretation of these spectra to determine the identity of any non-ice components of the surface. These materials are of interest for many reasons, particularly as evidence of the satellites' original composition, thermodynamic evolution, chemical alteration due to surface processes, and infall of materials. At the time of the writing of this abstract, spectra have been analyzed for regions on Callisto and Ganymede, and more spectra are expected for all three icy satellites before this report is given. NIMS is providing up to 408-channel spectra over the spectral range 0.7 to 5.2 μm for spatial resolution varying from near 1 km to hundreds of kms. Early analysis reveals high-quality spectra exhibiting the presence of ice and non-ice spectral features, some not seen in groundbased telescopic data. These include a weak absorption at 4.25 μm, and differences in the broad 3μm hydration band. Other spectral features appear weakly including possible features in the 1 μm region. These bands vary in strength with location. Candidate materials identified so far for the 4.25 μm absorption include hydrated minerals exhibiting various metal-OH / OH or HOH combination bands. These bands are diagnostic of specific minerals. The 4.25 μm band also may be explained by CO_2, probably in a clathrate, with amounts modeled to be 0.5 wt% CO_2 on Callisto and 0.2 wt% CO_2 on Ganymede, on the average. Modeling studies are underway to clarify this interpretation. This band appears to be approximately twice as strong on Callisto as on Ganymede, and there are considerable spatial variations, including on Ganymede a patchy concentration near the equator. Comparison of these spectra with groundbased telescope spectra shows consistency except for the obvious effects of much higher spatial resolution.

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